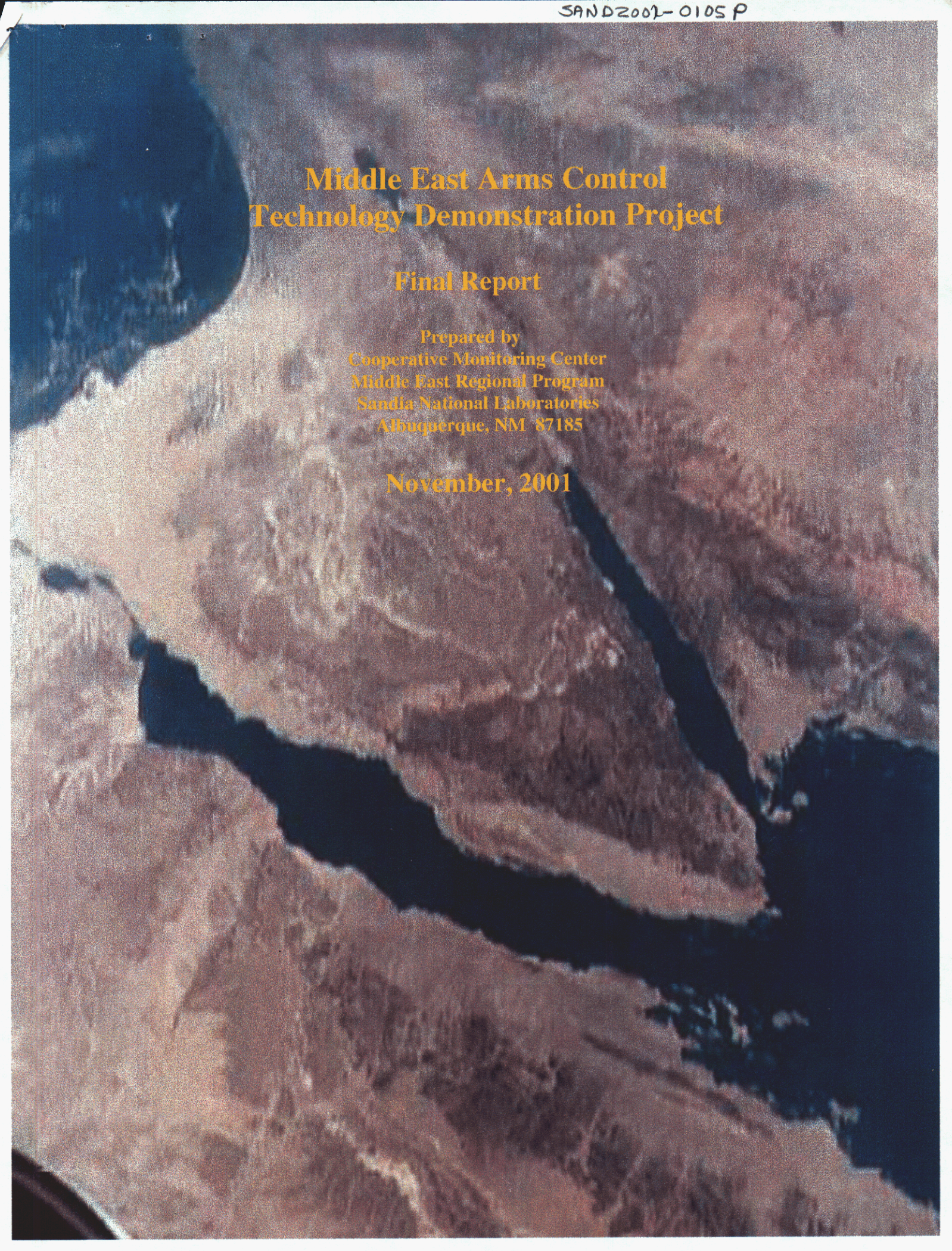
SAND2002-0105P



Middle East Arms Control Technology Demonstration Project

Final Report

Prepared by
Cooperative Monitoring Center
Middle East Regional Program
Sandia National Laboratories
Albuquerque, NM 87185

November, 2001

Middle East Arms Control Technology Demonstration Project

Cooperative Monitoring Center (CMC)
Sandia National Laboratories
Albuquerque, New Mexico, USA
November 2001

Contents

Cover Photo: This view of the Sinai has been adopted as the logo for CMC's Middle East Regional Program. Viewed from this angle, a person's hand in the form of a Peace Sign can be imagined. Peace in the Middle East is what we seek.

Project Overview

The purpose of this project is to evaluate opportunities for joint arms control (AC) technology evaluations in the Middle East with specific focus on Jordan, Israel, and Egypt.

The initial detailed planning meeting for this project was held in early December 2000. At that meeting a more detailed "statement of work (SOW)" was developed (see Section I). To begin implementation of the SOW, CMC traveled to Egypt and Jordan in late January 2001, to meet and gather the necessary support from key Arab AC organizations. We were unable to obtain DOS-clearance for travel to Israel because of the current intifada. However, CMC already has strong ties with Israeli arms-control organizations so a meeting with them was not crucial. All organizations we met with wanted to cooperate with CMC on this project.

In early April 2001, a second project meeting was held. At the meeting it was decided that the primary focus of this work should be on technology, rather than policy. Thus, lengthy discussions of Middle Eastern politics should be avoided and CMC would focus on the details of the proposed technology-based projects. Thus, the format of this report is short and to the point.

We decided the best way to complete the work was to invite 3 visiting scholars (2 from Egypt's Atomic Energy Authority and another from Jordan's Royal Scientific Society) to work at the CMC during the summer of 2001. In addition, another local Egyptian scholar (University of New Mexico) joined the team at key meetings to provide guidance. Prior to their arrival, CMC prepared a list of potential AC technology projects we wanted the scholars to consider. These projects were documented in an interim report prepared in May 2001. CMC believed these projects would help solve security problems in the region and had the potential for multi-country cooperation, thus advancing the peace process. Many of the candidate projects employed AC technologies of primary interest to CMC and Sandia National Laboratories. The evaluations of these and other potential projects by the Middle Eastern and CMC team are included in this final report.

The team concluded that many AC technology projects are feasible, but the logical first step to launching new projects is to establish an "AC technology outpost" in the region, i.e., a CMC-like facility, either in Amman or Cairo. This facility will be fashioned after Sandia's CMC and will serve as a forum for regional training on nonproliferation technologies, indigenous development of AC technology projects, and multidisciplinary interactions among Middle Eastern technocrats, policy-makers, and security specialists. We envision that Sandia's arms-control technologies and training expertise will become an integral part of this facility. Budget for launching this project in 2002 is being secured from DOE and CMC will soon meet with DOS to finalize our plan and to gain approval for moving forward.

I. Statement of Work

Sandia's Cooperative Monitoring Center (CMC) will foster the development of arms-control/monitoring expertise within the Middle East. Initial focus will be on Egypt, Jordan, and Israel because the existing peace treaties among these countries may ultimately allow cooperative technology projects. The CMC will identify and meet with arms-control organizations within each of these countries. Bilateral working agreements between CMC and the key organizations will be established and we will work with them to identify and prioritize country-specific security and arms control problems. For problems given highest priority (that are also politically acceptable to work on) we will define the technology-based systems required to solve them. System demonstration projects will be defined along with a first-order cost estimate associated with deploying the demo in each country. A final report will be prepared. Information in the report will help us solicit additional funding from US and/or Middle East organizations to deploy one (or more) arms-control-system demos during 2002.

CMC worked with a team of scholars from Egypt and Jordan during the summer of 2001 to complete the project. The Middle Eastern scholars were Ali Ajlouni (Engineer, Royal Scientific Society, Amman, Jordan), Adel Ali (Political Scientist, Egyptian Atomic Energy Authority, Cairo, Egypt), Fawzy Hammad (ex-Lab Director, Egyptian Atomic Energy Authority), and Ahmed Hasan (Engineer, University of New Mexico).

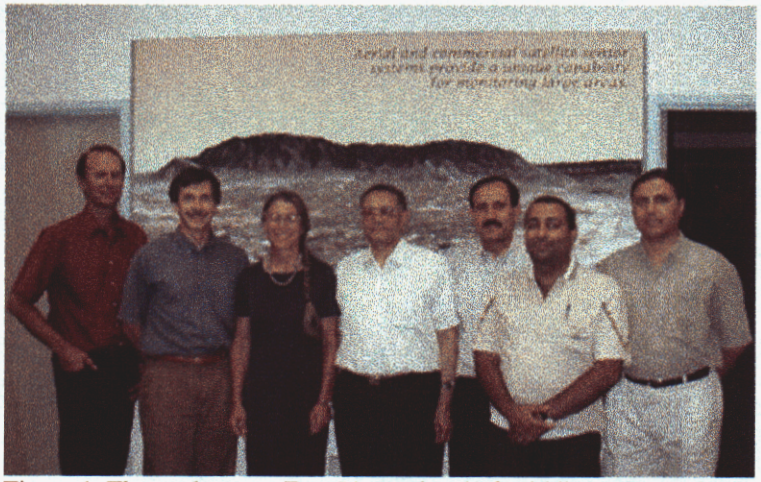


Figure 1 The study team (R to L) consisted of Middle Eastern scholars Adel Ali, Ahmed Hasan, Ali Ajlouni, Fawzy Hammad; and CMC staff Arian Pregenzer, Mike Vannoni, and Greg Kolb

II. Security Issues in Egypt, Jordan, and Israel

The CMC has many contacts in Egypt, Jordan, and Israel. The organizations we interact with on a regular basis who have interest in arms-control technology are listed below along with the security issues of concern to them. Security issues were gleaned during a trip to the Middle East in January 2001 and review of the literature [1, 2, 3]. Potential technology demonstration projects must address one or more of the security issues listed below. The issues listed for Egypt and Jordan are in order of importance as viewed by the scholars.

- Egypt
  - Organizations – Egyptian Atomic Energy Authority; National Center for Middle East Studies; Disarmament Division/Ministry of Foreign Affairs

- Security Issues – Assumed Israeli possession of nuclear weapons; Israel qualitative military superiority; Israeli spy satellites; removal of land mines; terrorism (exported foreign extremism); internal economic crisis; Nile Basin sharing with Ethiopia/Sudan;

- Jordan
  - Organizations – Royal Scientific Society (Disarmament/Security Studies Division); Jordan Army; Jordan Institute of Diplomacy; Center for Research on Arms Control and Security
  - Security Issues – Israel military superiority; lack of water; Palestinian problem; Palestinian refugee effect (>2M) on Hashemite Kingdom; Arab rivalry/disagreement; terrorists using Jordan as base of gateway; getting caught up in a war between Israel and another Arab state not at peace with Israel; assumed Israeli possession of nuclear weapons; radiation releases into Jordan from Israel's Dimona nuclear facility; lack of energy sources; removal of land mines; economic vulnerability and Israeli economy overwhelming Jordan

- Israel
  - Organizations – Israeli Atomic Energy Commission; Soreq Nuclear Research Center and their Shalheveth Freier Center for Peace, Science, and Technology; Besa Center for Strategic Studies; Jaffee Center for Strategic Studies
  - Security Issues – Surrounded by Arab countries; high population density and lack of strategic depth make it vulnerable to attack; Arab quantitative military superiority; terrorism (both Arab and Jew); missile attack/potentially with WMD; dependent on outside sources of energy; lack of water and other natural resources, economic isolation from Arab neighbors

It should be noted that the "assumed Israeli possession of nuclear weapons" was ranked significantly different by the Egyptian and Jordanian scholars. The Egyptians gave the issue highest priority, but several other issues were more important to the Jordanian. Much has been written about Egypt's concern and they are a leading advocate of establishing a Nuclear-Weapons-Free Zone in the Middle East [4, 5].

III. Goals and Objectives of Regional Arms Control

There are several goals and objectives of regional arms control. Potential technology demonstration projects must address one or more of the goals/objectives listed below [6]:

1. Reduce and/or eliminate actual weapons and/or delivery systems deployed
2. Limit or reduce arms race; military spending
3. Avoid misunderstandings, accidents, unnecessary preemptive attacks and escalation
4. Provide strategic and tactical warning. CBM's
5. Contain and deter rogue or high-risk states
6. Create a climate of trust and political good will; advance peace process
7. Limit the risk and cost of actual war fighting
8. Minimize the risk of civilian casualties and damage from armed conflict
9. Reinforce or create a stable structure of mutual deterrence

Cooperation on regional non-proliferation and arms control shall eventually be integrated within international agreements, and their verification systems, to enhance the strength and effectiveness of both systems. Further, through linkage, the region as a whole can benefit from global technical cooperation and the available experience. The current participation of Middle Eastern countries within these agreements is summarized in Appendices A and B.

IV. Initial Selection of Potential Arms-Control Technology Demonstration Projects

The demonstration project must address one or more of security issues listed in Section II, as well as one or more of the arms-control goals listed in Section III. The project should demonstrate the essence of technology and strive to achieve the "most bang for the buck." Likely funding sources for project should be identified. It should also be practical, politically acceptable, and promote cooperation among 2 or more countries in the region. Since Sandia's CMC will likely be involved in early projects, the proposed technology should match the resident expertise at Sandia.

Initial ideas for technology demonstration projects that are compatible with the guidance given in the previous paragraph are:

IV.1 Establishment of a Cooperative Monitoring Center in the Middle East
IV.2 Improved border security to prevent the passage of terrorists and smugglers
IV.3 Chem/bio/radiation detection to warn of the potential presence of WMD
IV.4 Open-Skies monitoring to build confidence
IV.5 Humanitarian removal of land mines
IV.6 Sharing of commercial satellite imagery to build confidence
IV.7 Advanced notification of aircraft overflights to build confidence
IV.8 Efficient transference of humanitarian goods across borders.

These ideas were obtained from several sources. We received several informal proposals from Israeli, Egyptian, and Jordanian arms-control experts during our January 2001 trip to the Middle East and through subsequent communications. Additional ideas were obtained from CMC experts as well as from information provided to CMC by others [7, 8, 9, 10]. These project ideas were evaluated in depth with the help of the visiting scholars from Egypt and Jordan during the summer of 2001.

The project evaluation summary is presented in Table 1. Establishing a CMC in the Middle East is given highest priority and will likely occur within CY2002, assuming funding from DOE can be secured and DOS approves the project. Other projects judged to be feasible could be fully implemented in the near term (1 - 3 yrs), mid term (3 - 5 yrs), or long term ($\geq$ 5 yrs), after the CMC is established.

The evaluations of these projects are discussed in the sections that follow. The reader should be cautioned that the list of potential projects evaluated here is not complete and the staff of the Middle East CMC could develop many new ideas for projects soon after it is established.

Table 1 Evaluation of potential arms-control technology projects in the Middle East

Arms Control Technology Project		Feasible in Near, Mid, or Long Term?	Next Steps
Establish a CMC in the Middle East		Nearest	Secure DOE funding and get approval from DOS
Improve border security	At unsupervised borders	Near	Meet with Jordanian Army HQ to define border experiment
	At entry/exit portals	Near	With Israelis, test next-generation portal and develop a plan for deployment
Identify potential presence of WMD in environment	Chemical agents	Mid	Define chemical detector demonstration project
	Biological agents	Near	Demonstrate RSVP software to medical doctors
	Hazardous nuclear radiation	Mid	Form a working group to define feasibility of data sharing
Open-Skies monitoring		Long	Education & training at Middle East CMC
Humanitarian removal of land mines		Mid	Education & training at Middle East CMC
Sharing of commercial satellite imagery		Long	Invite remote sensing experts to a workshop at Middle East CMC
Advanced notification of aircraft overflights		Long	Invite Gulf officials to workshop at Middle East CMC
Efficient transfer of humanitarian goods across borders		Mid	Invite Red Cross/Crescent officials to attend a workshop at Middle East CMC

IV.1 Establishment of a Cooperative Monitoring Center in the Middle East

The CMC is a facility, a center of excellence, that is intended to promote and support the study of technical aspects of regional security issues by officials, scholars, scientists, and others. In addition to promoting transparency and information exchanges, the CMC would assist by providing a range of confidence-building information, technology, and training. Such an institution would be similar to the CMC established at Sandia National Laboratories and would play an important role in demonstrating arms control technologies to a historically skeptical yet interested security community in the Middle East.

During CMC's visit to the Middle East in January 2001, the Egyptian Atomic Energy Authority (EAEA) expressed an interest in establishing a facility similar to the Sandia CMC.

Evaluation of Proposed Project

Sandia's CMC has long supported the establishment of a CMC-like facility in the Middle East [11]. A sister facility would greatly facilitate the launching of new arms-control and non-proliferation (ACNP) technology projects in the region. Starting and managing Middle-Eastern projects remotely from Sandia's CMC is difficult because of the extensive amount of coordination required. Establishing a "CMC outpost" would allow many locals to attend ACNP workshops and gain hands-on experience with technology options that will be displayed in a technology showroom. Education and training is the key to launching new ACNP projects in the region. Parties in the region must have a common understanding of the scope of the problem to be solved and the role that technology can play. If key people achieve a common understanding, they will jointly propose indigenous solutions to indigenous problems. Homegrown

projects have a much better chance of succeeding than those dreamed up by a remote CMC, half a world away.

After learning of EAEA's desire to establish a Middle East CMC, Sandia's CMC discussed the idea with our DOE program sponsors and formally requested funds to support the project in FY02. Current expectations are that DOE will provide ~$500K to launch a Middle East CMC project. Assuming approval is gained from DOS, initial activities could begin in January 2002.

The scholars and Sandia's CMC began a detailed investigation of the proposed Middle East CMC in early July 2001. The initial effort focussed on establishing the center at an existing facility within EAEA's Nasr City site, a suburb of Cairo. Dr. Fawzy Hammad, an ex-director of EAEA, championed the investigation and was the primary author of the project concept document, "CMC @ Cairo," appearing in Appendix C. Establishing the center at EAEA sounded especially appealing because Dr. Hammad stated that the facility, as well as the staffing of it, would be provided to the project "free of charge."

Key individuals from the disarmament group within the Egypt's foreign ministry, as well as the disarmament group located at Jordan's Royal Scientific Society (RSS) provided comments on the CMC @ Cairo document and gave their unofficial support for the concept. RSS stated they too wanted to be considered as the potential location for the CMC, but also stated they would support locating the CMC in Egypt, if that were the decision. In late July, the contents of CMC @ Cairo document were next presented to Michael Yaffe, a Middle East expert at the US Department of State (DOS) who has a long history of arms control issues in the context of the Middle East peace process [12].

The guidance provided by Yaffe's review gave direction to the investigations conducted in August and September 2001. While he personally supports the CMC concept, he suggested that a study was needed to decide whether regional vs. national CMC's should be established and to determine where the CMC(s) should be located. The countries he wanted the team to investigate were Egypt, Jordan, Oman, Qatar, Morocco, and Tunisia. These countries all have diplomatic relations with Israel (Egypt and Jordan have full; the rest partial) and were believed to willing to host visits to the CMC by Israeli nationals. While Yaffe agreed that Arab-Israeli issues do not have to be the main focus of the CMC, he emphasized that Israelis could not be excluded. Since US money will primarily be used to establish the CMC, the location of the CMC must have wide political support within the US government. Thus, the study team decided to compare the technical and logistical pros and cons of locating the CMC at different locations. The results of the investigation would be presented to DOS and they would decide on whether to proceed with the project.

The main conclusions of the study are 1) several national rather than a single regional CMC should be established, and 2) besides CMC @ Cairo, the first deployment of a national CMC could also be at the Royal Scientific Society in Amman (CMC @ Amman). The analysis that led to these conclusions is presented within 3 subsections that follow:

1. Several National CMCs vs. a Single Regional CMC
2. CMCs in Jordan vs. Egypt
3. Rationale for Eliminating Oman, Tunisia, Qatar, and Morocco As Sites for Initial CMCs

1. Several National CMCs vs. a Single Regional CMC

It is much more difficult to establish a regional cooperative center, meant to represent the interests of the entire Middle East, than to establish a national center that does not make this claim. In addition, we believe that a regional center is much more prone to long-term failure than a national one.

A multi-country board of directors would likely manage a regional center. The more parties involved, the more formal and difficult the political negotiations become. Historically, there was only one regional cooperative center that grew out of the Middle East Peace Process. This center, the Regional Economic

Development Working Group[1], began operating in Amman in May 1996. Its charter was to promote economic cooperation and identify areas of common interest, monitor and implement projects, and provide technical support to the Core Parties (Egypt, Israel, Jordan and the Palestinian Authority) in the development of initiatives. The center is manned by politically appointed representatives from each of the parties and is funded by the European Union, as well as the parties. In August 2001, we contacted the director of the center, Aaida Abu-Jaber, to determine the current state of affairs. Whereas the center was very productive in 1996 and 1997, it is in a current state of dormancy. She blamed the decline on the worsening political situation between the Israelis and Palestinians and admitted that politics governs and directs the center's activities. Her experience has been that "technical cooperation projects and activities, which are based away from politics, have an excellent chances for survival and success."

To avoid regional politics as much as possible, each country should manage their own CMC. While the charter of a particular "national CMC" would be to promote cooperative technical projects between the host country and its neighbors, as well as offering ACNP training to the region as a whole, participation by all countries is not a requirement.

As described in the next section, we suggest that a first "national-type" CMC be established at either RSS in Amman or at EAEA in Cairo. If the first deployment is successful, and if budget exists, a second deployment could be launched in the competing institution after ~5 years. The 2nd CMC would specialize in different ACNP technical areas than the 1st CMC and it would manage a different set of ACNP projects. For example, the 1st CMC may become the regional experts on border monitoring and associated projects, whereas the 2nd center may become the regional experts on WMD treaty verification technologies and associated projects.

2. CMCs in Jordan vs. Egypt

Using the Sandia CMC as a model, a Middle Eastern CMC should be located at a large national laboratory. This would allow the relatively small CMC staff to draw upon the broad technical skills of the national lab staff, on an as needed basis, to help implement projects. Of particular importance to a CMC, the lab needs expertise in monitoring technologies, computer networking and information technologies, systems analysis, and be well-connected with internationally-recognized experts in the field of arms control and non proliferation. In addition, since the CMC will often seek the services of local college professors and their network of international colleagues and graduate students, a strong university infrastructure is required. Finally, the CMC facility should allow easy access by foreign nationals.

During Sandia's exploratory trip to Jordan and Egypt in January 2001, we became aware of labs in each country that appeared to possess most of the necessary attributes for a CMC. Sandia discussed our desire to launch a CMC in the Middle East with the internationally recognized arms-control experts associated with each lab, Maj. Gen. Mohammad Shiyyab (RSS, Jordan) and Dr. Fawzy Hammad (EAEA, Egypt). Dr. Hammad exhibited particular interest and suggested that he come to Sandia's CMC for a few weeks to prepare a concept document. In addition, each expert agreed to provide a visiting scholar to Sandia for a period of 3 months to more fully study the concept of a Middle East CMC and to complete this project. Dr. Hammad visited Sandia during the first 2-weeks in July and for 1 week at the end of August and was the primary author of the CMC concept document in Appendix C. The visiting scholars worked at Sandia's CMC from July 1 to Oct 1; their primary role was to supply input to the initial CMC business plan and to provide information that allowed personnel from Sandia's CMC to compare the merits of EAEA vs. RSS, as described below.

EAEA is one of several national laboratories within Egypt. It is the primary nuclear energy lab in the country[2]. Approximately 1500 scientists, engineers, and technicians (included within a total staff of ~6000) man it's 4 research centers and extensive lab facilities. The ~$30 M annual budget is provided by the Egyptian government. Lab traits of particular interest to establishing a CMC include the following:

[1] http://www.index.com.jo/redwg/about/index.htm
[2] http://www.frcu.eun.eg/www/homepage/aea/aea.htm

- An extensive technology infrastructure exists at the lab, as demonstrated by their ability to operate the largest nuclear reactor in the Arab world (22000 kW_t, ETRR-2 facility).
- The lab operates and maintains an extensive radiation-monitoring network. Approximately 100 stations monitor radiation in the air, rivers, and sea throughout Egypt.
- There is a culture of arms-control treaty compliance at the lab. Two operating reactors are under full-scope IAEA safeguards and on-site inspections are routinely held to demonstrate compliance with the Nuclear Non-Proliferation Treaty.
- There is a culture of education and training at the lab and visits by foreign nationals to attend workshops are routine; EAEA trains other Arab and African countries on nuclear-related technologies.
- There is a strong tie between EAEA and the arms-control community. Several staff are members of an organization headed by Dr. Hammad called Egyptian Scientists Against Proliferation. Dr. Hammad is also involved with the WMD Middle East Free Zone project, headed by Dr. Bassiouny (Egyptian at Univ. of Chicago.)
- The EAEA is well connected with universities in the area.
- Israelis appear to be welcome at the proposed site for the CMC. Sensitive nuclear facilities are not nearby.

RSS is considered to be the primary national laboratory in Jordan. It is a multi-disciplinary lab composed of 6 technical centers with ~40 separate laboratories, and a separate quality assurance department. Total staffing is ~700. The ~$8M annual lab budget is "self-generated," which means that external customers supply the income. Lab traits of particular interest to establishing a CMC include the following:

- The capabilities of the computer technology center appear to be "state-of-the-art." It is manned by >100 people that have expertise in web-site development, information technology, and systems analysis. The RSS web site is one of the best we have found for any scientific institution in the Middle East[3].
- The environmental research center operates and maintains several monitoring stations throughout Jordan. These sensors detect nuclear radiation and air pollution in the environment.
- The electronic service center maintains bio-medical equipment in Jordan. They have an experienced design and maintenance staff that appears capable of developing new monitoring devices and systems.
- There is a culture of education and training at the lab. RSS has trained ~12 Arab countries on a variety of technical subjects. Workshop fees generate significant revenue for the lab.
- There is a strong tie between RSS and the arms-control community. Gen. Shiyyab's Department of Disarmament and Security Studies is located at RSS. Shiyyab is the prime Jordan representative at the Middle East Regional Security Group; a quarterly meeting organized by UCLA and funded by the USG. Shiyyab is also a member of Search for Common Ground.
- The RSS is well connected with universities in the area.
- Israelis have historically visited RSS facilities. They are currently cooperating on at least 2 technical projects.

The business plan for startup and operation of a CMC in either Amman or Cairo is presented in Table 2. Costs for years 4 and beyond would be similar to year 3. The funds to cover the NET COST would be supplied by CMC@Sandia for the first 5 years, via our USDOE program sponsor. The goal is for the ME CMC to be self-supporting in year 6. To achieve that goal the ME CMC should attempt to cover at least 30% of the TOTAL COSTS in year 4 and 60% in year 5.

Based on the qualitative comparison above and the business plan below, we conclude that either lab could be the host of a CMC. While the cost to the USG of establishing CMC @ Amman is expected to be somewhat higher, the political considerations may outweigh this difference.

[3] http://www.rss.gov.jo

Table 2 Cost Comparison for Initial CMCs in the Middle East

	CMC @ Amman			CMC @ Cairo		
	Year 1	Year 2	Year 3	Year 1	Year 2	Year 3
Tech Transfer from USA	275	175	125	275	175	125
Computers & Internet	15	5	5	50	25	25
Tech Showroom	65	30	30	65	30	30
Library	10	10	10	25	25	25
Workshops	25	50	50	25	50	50
Tech Projects	0	100	200	0	100	200
ME CMC Staff						
Director	30	60	60	0	0	0
Asst. Director	10	20	20	10	20	20
Tech. Staff (5)	70	100	125	0	0	0
Secretary	9	18	18	0	0	0
Travel	15	20	25	15	20	25
Facility Rent	30	30	30	0	0	0
Visiting Scholars	0	0	20	0	0	20
TOTAL COST	554	618	718	465	445	520
Income	(10)	(20)	(70)	0	0	0
NET COST	544	598	648	465	445	520

Each line item in Table 2 is discussed in the remaining paragraphs of this section.

Tech Transfer from USA - These are CMC@Sandia staff costs, including travel costs to the Middle East. The majority is associated with teaching arms-control and cooperative monitoring workshops and setting up the technology showroom. In the first year, there will be one workshop and CMC@Sandia will teach it in its entirety. The staff of the ME CMC will be trained before, during, and after the workshop, and the supporting materials will be given to them. In years 2 and 3, there will be 2 workshops each year and the ME CMC staff will be responsible for teaching most of them. CMC@Sandia will attend the workshops to provide help, but will not have a lead role.

Computers & Internet - Each staff member at the ME CMC will have their own computer. The computers will be connected via a LAN, and to the Internet via a hi-speed link. A web-site will be developed that describes the activities of the CMC. Cooperative-monitoring data produced by regional projects will also be posted on this website. Since the existing computer infrastructure at RSS is more advanced than at EAEA, the cost entries for CMC@Amman are lower.

Technology Showroom - Several "hands-on" technology demonstrations will be on display in the showroom. In the first year, we propose to purchase "key technologies" that are currently on display within CMC@Sandia's showroom. Key technologies identified by the visiting scholars are 1) ground sensors and portable CMC, 2) tamper indication, 3) nuclear radiation monitoring, and 4) computer software that supports arms-control and cooperative monitoring, to include a) ACE-IT on-site inspection simulator, b) remote sensing, c) unattended material monitoring, d) cooperative epidemiology, e) SIMTOOL cooperative monitoring simulator. In years 2 and beyond, we assume that new (currently undefined) technology displays will be added to the showroom.

Library - Book purchases and subscriptions to international journals are covered by this expense. EAEA is especially interested in establishing and maintaining a significant "hard-copy library." Another approach is to rely more heavily on an "electronic library," much of which can be found on the Internet. Since the computer infrastructure is more advanced at RSS, they should rely more heavily on an electronic library, thus reducing this cost item.

Workshops - Workshop materials, meals, and per diem for out-of-towners are included in this expense. We assume that 20 students will attend each workshop. One workshop will occur in year one, with 2/yr thereafter. Technical preparation by teachers is not included here; it is included within Tech Transfer and ME CMC staff costs.

Technology Projects - This budget item will be used to cost-share new ACNP technology projects within the region. Several examples of possible projects are described in sections IV.2 through IV.9 of this final report. We anticipate launching the first new project in year 2.

ME CMC Staff - The staffing assumption is similar to Figure C-2 of Appendix C. Since EAEA will supply staff to the CMC "free of charge," CMC@Cairo's costs are zero. RSS staff will not be supplied for free, and the costs reflected in the table for CMC@Amman assume part-time staffing in year 1, ramping up to full time by year 3. The assistant director is a part-time position that is supplied by the competing institution. For example, if we choose to establish the CMC at RSS, then EAEA would supply an assistant director to help manage CMC@Amman and to coordinate cooperative projects of interest to both Egypt and Jordan. To maintain the idea that the CMC should be a national rather than a regional institution, the assistant director would not have budget authority and would act as more of a consultant.

Facility Rent - Since EAEA will supply the facility (depicted in Figure C-1 of Appendix C) "free of charge," CMC@Cairo's costs are zero. Facility space will have to be rented at RSS. The cost estimate in the table is typical for 500 m^2 of commercial office space at RSS or nearby.

Visiting Scholars - Part-time experts will be hired, on an as needed basis, to work with ME CMC staff to perform ACNP technology studies.

Income - The RSS has historically charged a fee to attendees of technical workshops. This generates income to help offset expenses. This practice will continue for workshops held at CMC@Amman to generate a small amount of income in years 1 and 2. Starting in year 3, in addition to workshop income, we assume that money from non-USG donors will begin to become significant. Historically, RSS has received funds from several institutions[4] and it is believed that several of these would pay for work performed by CMC@Amman. RSS is a non-profit institution with a budget that is "self generated," so it is standard business practice for them to seek outside funding sources. EAEA is a government-funded lab that is not required to seek outside funding to exist. Thus, we believe that CMC@Amman will start to become self-sufficient sooner than CMC@Cairo, and this belief is reflected in the numbers in the table. The goal is for the ME CMC to not be dependent on funding from CMC@Sandia, or the USG more generally, after 5 years.

3. Rationale for Eliminating Oman, Tunisia, Qatar, and Morocco as Sites for Initial CMCs

We performed a cursory search for other possible CMC-host laboratories located within the countries suggested by Mike Yaffe. This search began with a broad review of the infrastructure of technical institutions in the Middle East-North Africa (MENA) region. Of particular interest were reviews performed by United Nations [13] and the International Development Research Center [14]. Major conclusions of these reviews are:

- Studies of science institutions in Arab countries are rare and deeply analytic ones are almost non-existent. Even directories and surveys of institutions in Arab countries are hard to come by, and seem to be generally deficient.
- Throughout MENA, the number of research institutes has recently begun to grow rapidly. Nevertheless, the lack of well-defined national research strategies limits their effectiveness. Links between policy-making and research projects are extremely weak. Much university research tends to be abstract rather than applied.

[4] See http://www.rss.gov.jo/coop1.html for list of organizations.

- A generally low level of regional information sharing exacerbates the weakness of national research outputs. Computerization offers possibilities for rapid progress in regional networking, but computer literacy and Internet access are not widespread.
- Rather than the absence of institutions, or shortage of qualified personnel, the problem is the presence of inefficient, ineffective — though sometimes very large — organizations.
- R&D spending in MENA is low relative to the western world (0.2% vs. 3% of GDP).

Additional relevant, high-level, information we collected about the 6 countries of interest is presented in Table 3. Based on this comparison, we eliminated Tunisia, Oman, and Qatar due to the lack of universities and very low R&D spending. While the general health of technical institutions in Egypt, Morocco, and Jordan is not great according to the UN, they fare better in a relative sense.

Table 3 R&D Infrastructure vs. Population

	% of Arab Population	% of Arab R&D Personnel	Number of Universities	Annual R&D Spending (% of GDP)
Egypt	26	58	18	0.4
Morocco	11	11	8	0.2
Tunisia	3.7	1.8	1	0.1
Jordan	1.5	2.3	14	0.3
Oman	0.6	0.6	1	0.1
Qatar	0.2	0.1	1	?

Since Morocco was not represented on the study team, we had to resort to the Internet to obtain information. Websites for scientific laboratories are sparse, but a good website exists for their nuclear lab (Centre National de l'Energie, des Sciences et des Techniques Nucléaires (CNESTEN)[5]). However, other information [14] indicated this was a small lab (only 40 researchers), which we believe is too small of a lab for a co-located CMC to draw upon for help. Other scientific institutions in Morocco were not given a favorable review [14]. This fact, and the belief of the study team that the CMC should be located within a Core Party to the Middle East Peace Process, eliminated Morocco from further consideration as being the first site for a CMC.

IV.2 Improved border security to prevent the passage of terrorists and smugglers

Terrorists and smugglers can enter/exit a country over an unsupervised border or at official entry/exit portals. Thus, we propose 2 different technology demonstration projects that apply to each of these situations.

IV.2.1 Improved security at unsupervised borders

The CMC has recently worked with officers from the Israeli Defense Forces and the Jordanian Army to define the technical characteristics of improved border security systems within the Middle East [15, 16]. Generic models of unilateral and cooperative-type systems were investigated, as well as specific recommendations for systems to be deployed along Jordan's borders. In this section, we propose technology demonstrations for possible deployment in Jordan.

Security Conditions Along Jordan's Borders [16]

Jordan is surrounded by Israel, Syria, Iraq, and Saudi Arabia. The security conditions for each of these borders are summarized below:

[5] http://www.cnesten.org.ma/indexC1024.asp

- **Israel** – The peace treaty established between Jordan and Israel in 1994 has significantly reduced the threat of military invasion across this border. Both parties recognize the international border, as well as each other's territory, territorial waters, and airspace as inviolable. There are 4 official border-crossing points. Jordan's main concern today is the infiltration by Palestinian sympathizers and terrorists into the West Bank. Jordan and Israel have implemented a system for coordination in border security. Twelve liaison officers are posted in each country. Potential security incidents are communicated from the border security units to the military headquarters through the liaison officers to the other side.
- **Syria** – There are 2 official crossing points but nomadic Bedouin tribes are permitted to cross the border in either direction to graze their animals. Local Jordanian and Syrian military commanders hold monthly meetings. There is no direct communication to prevent illegal crossings. Most of the illegal crossings are from Syria to Jordan. Palestinian and terrorist groups infiltrate Jordan for political purposes and to smuggle arms[6]. Drug smugglers cross Jordan to deliver their product to Saudi Arabia, Egypt, and Israel. The Bedouin Desert Police have traditionally used camels to patrol the roadless and rugged areas of this border.
- **Iraq** – There is 1 official crossing point. The Jordanian army patrols the border and has built a ditch and berm along the entire border to discourage illegal crossings. Local Jordanian and Iraqi military commanders hold monthly meetings. There is no direct communication to prevent illegal crossings. Illegal immigration from Iraq to Jordan is the main concern. The current economic sanctions are causing Iraqis to emigrate in order to seek a better life elsewhere. In addition, recent news reports suggest that a significant amount of smuggling to Iraq from Jordan is ongoing (goods prohibited by sanctions).
- **Saudi Arabia** – There are 3 official crossing points but nomadic Bedouin tribes are permitted to cross the border in either direction to graze their animals. Saudi has built a patrol road parallel to the border as well as observation posts every 2 km. Jordan, with fewer resources, conducts patrols but has far fewer observation posts. The Jordanian army patrols the eastern and western parts of the border; the Desert Police patrol the center. An informal agreement between Saudi and Jordan permits security forces to cross into the other country up to a distance of ~10 km. Security force commanders in both countries have active coordination and communication. Smuggling from Jordan into Saudi Arabia is the major concern.

Solutions to Jordan's Border Security Problems

- Analysis conducted by CMC and the Jordanian military officer suggested an ~$81 M capital upgrade to the Jordan's border security system with an increase in the annual operations and maintenance budget of ~$14 M/yr. Figure 2 shows a diagram of the conceptual Jordan system including security unit deployment, command centers, and monitoring equipment.

[6] More than a dozen terrorist groups are operating in the region. See http://www.ict.org.il/

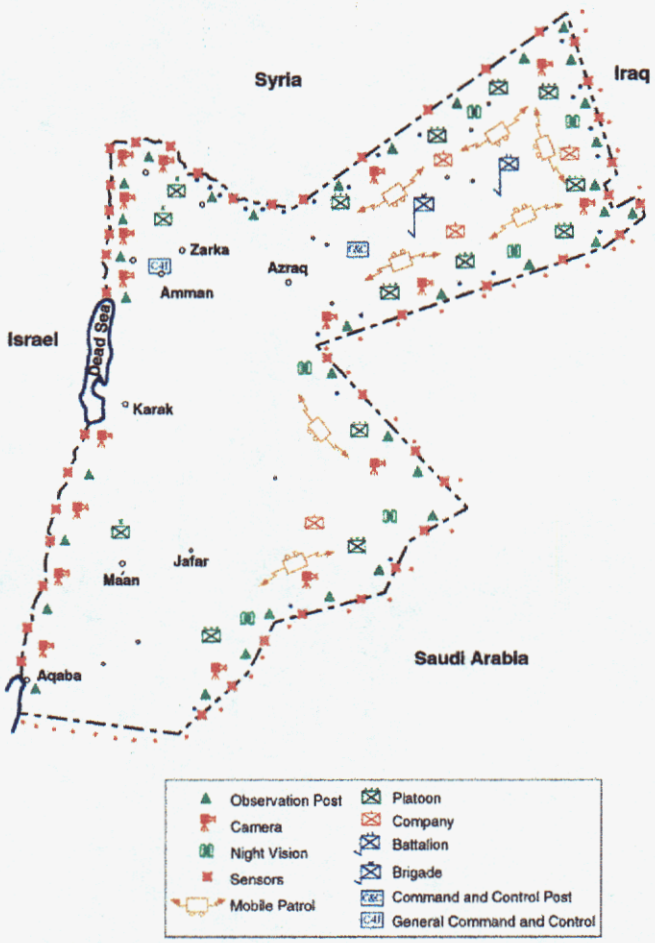


Figure 2 Conceptual Design of a Border Monitoring System for Jordan

The $81 M capital purchase is split into subcategories:

- $2.3 M devoted to unattended sensors, such as seismic, break-wire, pressure sensing cable, and infrared intrusion.
- $8 M for 40 km of taut-wire fences near the border crossing with Iraq and near Aqaba
- $13 M for long range infrared and night-vision devices
- $2.5 M for long range (40 km) ground radar systems
- $3 M for communications
- $43 M for transportation, >80% of this is for the purchase of additional helicopters
- $7 M for weapons purchases
- $2 M for engineering equipment such as earth movers.

Further analysis suggests that Jordan has little experience with unattended sensors and long-range ground radar technology. In addition, there is no integrated communication, tracking and control system of the widely dispersed Bedouin Desert Police and other forces along the border. Jordan does have experience with the remaining technology but in some cases it is relatively old and requires high maintenance.

Proposed System Demonstration

The proposed system demo should focus on technology areas where Jordan and a neighboring country have the least experience, such as the use of unattended sensors. This is also a cost-effective demonstration; it is the least expensive element of the total border security system described above.

Jordan and Saudi Arabia are already cooperating on border security. Their border is not politically sensitive (unlike Israel) and thus we believe the demo should be placed there. We propose that several seismic sensors be buried over a 2 km stretch between two of the Saudi-Arabian guard towers. If a sensor were tripped, the Saudi guards would be alerted to scan the area using high-powered binoculars with night-vision capability. If an intruder were identified, a tower guard would direct the Jordanian Bedouin Police to the interception point via radio communication. The tower guard will know the precise location of the Bedouin Police because the radios will include GPS capability (Automatic Packet Reporting System[7]). Power to the guard tower is assumed to be supplied by a small solar-photovoltaic/battery system. The initial cost breakdown for this demonstration project is presented in Table 4.

Table 4

Cost Breakdown for Border Monitoring Demonstration Project

Sensor System	$50 K
Labor	$40 K
On-site Costs	$5 K
Travel	$25 K
Training	$10 K
Shipping and Handling	$5 K
VAT	$10 K
Misc. Capital Costs	$15 K
Project Development + Contingency	$90 K
TOTAL	$250 K
Spare Parts	$5K/yr

Addition of this technology should greatly increase the probability of intruder intercept. Without it, intercept relies entirely on the continual scanning of the border by the guards in the towers. This is a mind-numbing task with a high failure rate.

The proposed project is practical and should work well. We purposely avoided technical approaches which experience suggests are prone to failure. For example, the CMC does not believe that unattended video or radar surveillance devices are practical in this region. These devices are hard to camouflage and would likely be stolen by the Bedouin groups that graze their animals in the area. Last year, CMC weather-measurement equipment was stolen in Israel. The unattended equipment was contained within a security fence and was believed to be stolen by a roaming Bedouin group.

Evaluation of Proposed Project

The visiting scholars discussed the proposed project with Col. Mazen Qojas, the Jordanian military officer who performed the border study depicted in Figure 2. Col. Qojas has retired from the military and now works for the Amman Center for Peace and Development (ACPD). Qojas believes the technology demonstration project should be located at the Jordan/Israeli border near Aqaba. A demonstration located here could support a larger project that ACPD is developing with Israeli partners to improve border security.

Col. Qojas has received the blessing of the General Headquarters of the Jordanian Army to proceed on the demonstration project. He believes the original cost estimate provided in Table 4 is still reasonably valid,

[7] http://www.lerc.nasa.gov/WWW/MAEL/ag/aprsintr.htm

even though a somewhat different situation exists at the Aqaba location, i.e., unlike the Saudi case, both countries man the guard towers and no camel-police is operating here. As the next step, he suggests a workshop be held to finalize the details of the demonstration project and to revise the cost estimate. This workshop should ideally occur at the proposed Middle East CMC. Following the workshop, Sandia's CMC would help supervise installation of the hardware and provide training to the border guards. Funding could come from the Jordan and Israeli armies and/or from budget intended for the Middle East CMC (see Tech Project funding entries in Table 2).

IV.2.2 Improved Security at Entry/Exit Portals

Terrorists and smugglers work with a wide variety of explosives and illicit drugs. Exposure to these chemicals leaves miniscule traces on their clothing or within their vehicle that can be detected with new "sniffer-type" security portals. Sandia is developing several types of sniffers; an example of one that will screen people is shown in Figure 3. The new portal looks like an airport metal detector with vents and nozzles on its inside walls and ceiling. The person to be screened stands inside the portal for ~12 seconds as the detector blows a quiet, gentle puff of air over them. An air sample is collected and passed through a commercial ion mobility or mass spectrometer (depending on model). The system's software recognizes the chemical signatures of a variety of explosives and illicit drugs.

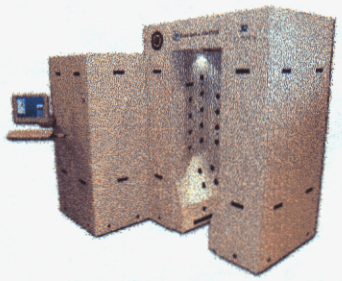


Figure 3 Explosive Detection Portal Developed by Sandia National Laboratories

Sandia and Soreq Nuclear Research Center (Israel) have considerable expertise in the development of advanced security portals and, through a formal agreement between our laboratories, we are allowed by the US Government to pursue joint projects [17]. We propose that one or more explosive detection personnel portals be deployed for tests within Israel or at a border crossing. Candidate locations within Israel include the international airport or at bus stations. Viable border crossings are between Taba (Egypt)/Eilat (Israel), as well as Aqaba (Jordan)/Eilat. We prefer deployment at these 2 border crossings because it would be a good confidence building measure among the security forces of Israel, Egypt, and Jordan. It is also a practical location because the very close proximity of the 2 border crossings will allow common maintenance. Installation at an Israel/Palestinian border crossing was eliminated from consideration due to safety concerns and the current political controversy associated with these borders.

The cost of a project that deploys a portal at each border crossing is ~$500K. The direct cost of 2 portals is ~$200 to $250 K. We double that amount to cover the indirects associated with installation, training, spare parts, and a 3-yr maintenance budget. Sandia has a licensing arrangement with USA's Barringer Corporation so we believe the technology is exportable (at least 1st generation models).

The Israeli Security Agency has expressed considerable interest in this technology so they are a potential funding source for this project. In addition, Sandia and Soreq have been asked to participate in the Technical Support Working Group (TSWG) chaired by the Department of State [27]. The TSWG develops and demonstrates anti-terrorism technology. A significant portion of the TSWG budget is devoted to a

USA/Israeli bilateral agreement to develop advanced-technology projects. We plan to present this project idea to TSWG. With the help of our visiting scholars, we will assess the likelihood of a joint project between Israel, Jordan, and Egyptian

Evaluation of Proposed Project

In September 2001, Sandia used DOE funds to purchase a Barringer portal to be delivered to Sandia in March 2002. The delay will allow Barringer to incorporate technology improvements identified during a recent design review meeting. Upon delivery, Sandia will perform in-house tests to assess explosive-detection capabilities (TNT, RDX, PETN, C-4, Detasheet, and Semtex) and reliability. Additional testing at Albuquerque's international airport may also be performed. If Sandia is satisfied with the performance of the unit, it will be shipped to Soreq (Israel) during the summer of 2002.

Sandia and Soreq presented their portal project to the TSWG group in November 2001. Current plans call for Soreq to integrate radiation detectors to allow the portal to simultaneously detect the presence of explosive and nuclear threats. A rash of events in which nuclear materials were smuggled out of the FSU prompted the decision to include radiation detectors[8]. In 2003, Soreq and Sandia hope to deploy the multi-purpose portal at a border crossing. Rather than deploying 2 portals near Elat, as originally proposed, the current plan calls for the deployment of a single portal at a border crossing between Israel and Jordan. The exact location will be negotiated during 2002.

The Egyptian and Jordanian visiting scholars expressed considerable interest in this technology and the ongoing Sandia/Soreq project. They consider this to be high-priority technology and would like to test a portal at an airport or at a border crossing in the near term. The proposed demonstration at the Israeli-Jordanian border should therefore be perceived as an excellent project that serves the needs of both countries.

IV.3 Chem/bio/radiation detection to warn of the potential presence of WMD

IV.3.1 Detection of chemical agents

Sandia's chemical-sensor experts believe the most cost-effective commercially available Chemical Agent Detector is the GID-3™ built by Graseby Dynamics. It detects the most common nerve and blister agents and can be programmed to detect other agents such as blood, choking and chlorine gas. It is the NATO-approved detector and thousands are in use, especially in Europe. The cost of the detector is $7K if purchased through DOD and about $20 K if purchased otherwise.

The portable detector is compact (breadbox size) and intended for intermittent use. If the system operates continuously, reliability is degraded due to the lightweight design of the internal pump and filter. At the request of DOE, Sandia is currently modifying the design to achieve reliable, 24/7 operation for non-mobile applications. There are no patent issues associated with Sandia's modifications, and if our modifications are successful, we intend to inform Graseby of our changes so they can possibly market a new version of their product

We propose installing a few of these modified 24/7 detectors (or another, as appropriate) within the air inlet ducts of one or more high-security buildings within the Middle East. Sandia experts suggest the modified detector should cost less than $40 K each. Project costs depend on the number of detectors deployed and on overheads (typically a factor of 2). We suggest a project in the $200 to 300 K range that involves the cooperation and sharing of data/experience between 2 Middle Eastern countries.

[8] For example, according to the Turkish Atomic Energy Authority, there have been 104 attempts to smuggle nuclear material into Turkey in the last 8 years. Alex Schmid (head of anti-terrorism at United Nations) has stated that smuggling routes are shifting to the Middle East and Asia.

Figure 4 GID-3™ Chemical Agent Detector
Dynamics

Evaluation of Proposed Project

Even though installation of these detectors in the air duct of high-security buildings appears to be a good application for this technology, it is not a good project from a cooperative standpoint. If a country were trying to protect a high-security building, it would not be in that country's security interest to tell others which building they are trying to protect and how effective the detectors are. Terrorists would like to obtain this type of information. Perhaps a more logical cooperative project would be to monitor the ambient air at a border crossing with a bank of these detectors. They could alarm the security forces from both countries of a possible terrorist attack. The equipment would be jointly purchased and maintained.

We learned that GID-3 detectors are already being used by militaries within the Middle East [18]. Upon return to their homes in Jordan and Egypt, the scholars will pursue possible cooperative projects that use this technology. They will contact their respective militaries to identify who is actually using the detector and to discuss if there is interest in sharing the data/experience of these detectors with other militaries in the Middle East.

IV.3.2 Detection of biological agents

Current bio-weapon detectors are much less effective than chem-weapon detectors. Due to a general lack of sensitivity, bio detectors are generally incapable of warning an individual before receiving a lethal dose of the bio agent. Improved biosensors are a subject of intensive R&D and commercial sensors, suitable for export to the Middle East, are unlikely to be available anytime soon.

Exposure of a population to a bio weapon could result in an epidemic. The tracking of epidemics and their medical symptoms are important elements of epidemiological and syndromic research, respectively. If this tracking could be accomplished on a real-time basis, the number of victims could be reduced dramatically; the sooner the location of the outbreak is identified, the better chance the medical community has to contain and treat the disease.

Sandia recently developed a real-time syndromic tracking system known as RSVP. Since mid 2000, RSVP has been subjected to alpha testing within a network of medical clinics at the University of New Mexico. The details of this software-based tracking system are described on the internet [19]. It must be emphasized that the primary use of RSVP is to track illness and disease from non-bio-weapon sources. Thus, this product will also be useful in areas where bio weapons are not a threat.

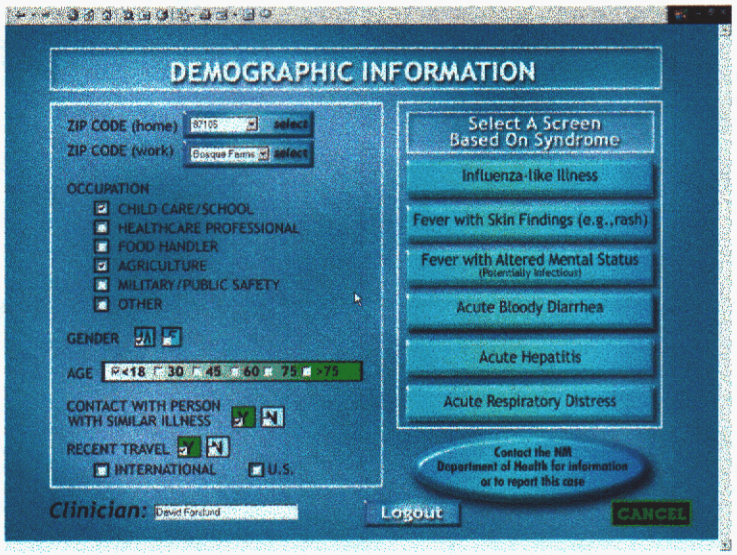


Figure 5 A physician enters a patient's syndromic data into the RSVP software. The data is instantly communicated to physicians at other locations via the Internet.

We propose that RSVP be used to perform syndromic tracking at 9 (judiciously chosen) medical clinics within Egypt, Jordan, and Israel[9]. A dedicated computer that is hooked to the Internet is all that is required at each of the 9 sites. The current RSVP software would be converted to Arabic and Hebrew if deemed necessary. Training on use of the system would be conducted from Sandia to the Middle East sites over the Internet.

Evaluation of Proposed Project

The terrorist attack on September 11th, as well as the subsequent anthrax exposures and scares, have greatly increased national attention to RSVP and to Sandia's developer, Dr. Al Zelicoff. At the time of this writing, ~150 RSVP deployments are being planned for the USA. This national effort could delay the full implementation of the proposed project for the Middle East because the software deployment team will be busy taking care of USA's needs.

Prior to September 11th, Dr. Zelicoff demonstrated RSVP to the Middle Eastern scholars on a computer at Sandia's CMC. The Egyptian scholars were especially interested and wanted to immediately try demonstrating it to medical authorities in Egypt. The initial authorities in Egypt were identified, and progress was being made to conduct the training over the Internet, when the events of September 11th unfolded.

We are hopeful that the initial training can be conducted within the next several months. If the Egyptian medical authorities believe that RSVP is a valuable tool, we will propose a project similar to that described above. As time and the availability of training personnel permit, we will try to schedule similar demonstrations to medical authorities with the help of our contacts at the RSS in Jordan and Soreq in Israel. Eventually, we hope to share data between the 3 countries. This coordination would likely be managed from the Middle East CMC.

Direct costs for this project are ~ $10K/site. We double this to include the indirects associated with project development and the preparation of a final report at the end of a 1-yr trial. Total project cost is ~$180 K if we gain involvement from all 3 countries.

[9] The Israel Center for Disease Control expressed interest in RSVP during a recent visit to CMC.

IV.3.3 Detection of hazardous nuclear radiation

Nuclear radiation is monitored at many locations throughout the Middle East. For example, the radiation network operated by the Egyptian Atomic Energy Authority (EAEA) was demonstrated to the CMC during our visit in January 2001. Perhaps 100 stations monitor radiation throughout Egypt: international borders, major cities, nuclear test sites, and within the waters of the Suez Canal and Nile River. The EAEA has proposed that Egypt's radiation network be integrated with the Jordanian network (~10 stations) as a confidence building measure.

Evaluation of Proposed Project

Nuclear issues are sensitive in the Middle East. For example, Egypt and Jordan have expressed concern about potential radiation releases from Israel's Dimona reactor.[10] In addition, many Arab countries are upset that Israel has not signed the nuclear non-proliferation treaty. Due to this political sensitivity, the US State Department has given guidance to the CMC that Israel needs to become part of the cooperative radiation-monitoring network before CMC develops this project.

Electric power utilities in Japan, Taiwan, and South Korea are currently posting radiation data on the Internet under the auspices of CMC's Northeast Asia program.[11] Since there are many power reactors in these countries, this transparency measure is helping alleviate nuclear safety concerns expressed by the public. Perhaps a similar cooperative program involving Israel, Jordan, and Egypt could do the same.

Only non-power reactors currently exist in Israel (26 MW_t at Dimona and 5 MW_t at Soreq Lab) and in Egypt (2 MW_t and 22 MW_t at EAEA). Jordan has plans to build a small (0.03 MW) non-power reactor that will be operated by their Atomic Energy Commission. Individuals from EAEA, Soreq, and the Jordanian AEC need to get together to discuss the feasibility of developing a cooperative radiation-monitoring project. This meeting could occur during a workshop to be held at the proposed Middle East CMC. At the workshop, personnel from Sandia's CMC would give a detailed presentation of the Northeast Asia project.

IV.4 Open-Skies monitoring to build confidence

Cooperation in aerial observation offers an opportunity to establish a useful tension reduction measure in the Middle East. Training in aerial observation, based on the Hungary-Romania bilateral agreement, could act as a confidence building measure (CBM) with minimal risks to the countries involved. This project would offer training in *Open Skies Treaty* methodology through a workshop hosted by Hungary and Romania and with supporting participation by Sandia's CMC.

The basic concept is that 2 or more Middle Eastern teams could be invited to fly as observers in a Hungary-Romania aerial observation flight. Officers from the countries could develop a shared understanding of how aerial observation missions are negotiated and carried out. This CBM merely provides a common technical and procedural background and does not obligate either party to further actions. However, further exploration of tension reduction measures will be far more likely as a result of a shared understanding of technology and procedures. As an initial military-military measure, this is attractive because it would take place at a neutral location with no security risk. In the long term, development of an aerial observation agreement in the Middle East could serve as an important component in a regime of Arab/Arab or Arab/Israeli tension reducing CBMs.

There are two advantages to proposing this training through the Hungary-Romania bilateral agreement: First, the two parties are currently engaged in flights with simple aircraft and photographic systems. As a

[10] http://www.arabicnews.com/ansub/Daily/Day/010531/2001053124.html and http://www.arabicnews.com/ansub/Daily/Day/000211/2000021103.html

[11] http://www.cscap.nuctrans.org/topcooperationinair.htm

result, neither cost nor technical intimidation should be a concern. Secondly, a similar project involving North and South Korea has already been proposed.

The suggested mechanism for launching this Middle East project is to "piggy back" on the Korean project currently being pursued by Hungary and CMC. A ranking Hungarian official has informally expressed great interest in the Korean project so it is likely that he would also be interested in a similar project involving the Middle East.

Sandia's CMC could provide briefings related to aerial observation missions and the background on *Open Skies Treaty* negotiations, as well as cooperative precedents that used aerial and satellite images for security and environmental cooperation.

Evaluation of Proposed Project

Training on Open Skies technology is proposed in this project. Initial information was presented to the visiting scholars and 11 others from the Egyptian government during the International Managed Access Workshop held at the CMC from August 27th to September 1st, 2001. At the workshop, the Open-Skies Treaty and monitoring-technology platform were described. Dr. Alaa Issa, head of Egypt's Disarmament Division at the Ministry of Foreign Affairs, expressed considerable interest in receiving more education and training regarding Open Skies. Thus, we plan to expand the discussion of this subject within future workshops to be held at the proposed Middle East CMC. This seems like the logical next step; the in-flight training originally proposed would likely occur much later, when the political will for such flights is much closer to fruition. The political situation is described below.

The East-West Open Skies Treaty will soon enter into force. Even though it is legally possible for a Middle Eastern country to join the treaty as soon as 1-year after EIF, it is unlikely that any would do so in the near term. Because the treaty calls for the use of highly capable sensors and far-ranging overflights by foreign nationals, this CBM has logically followed less intrusive or more restrictive CBMs. For example, the Conference on Security and Cooperation in Europe completed a long list of CBMs (communication links, inspections of military exercises, etc.) before negotiators turned in earnest to Open Skies. In addition, when sophisticated offensive capabilities exist in large numbers and at close proximity in regions of tension, as was the case in Central Europe and continues to be the case in the Middle East, too much transparency can do more harm than good [20, 21]. Israel is especially worried that images from aircraft and satellites could provide targeting information to terrorists and they pressured the USA to pass a bill that prohibits the release satellite images with greater than 2-m resolution [22].

Cooperative overflights are already occurring by 3rd parties in the Sinai peninsula to help monitor the peace treaty between Israel and Egypt [21]. The flights occur at least 2 times per month and are manned by the Multi-national Force of Observers (MFO) [23]. Helicopters, without a sensor platform, are used to support the peacekeeping force of 1900 stationed in the Sinai. The annual cost of the MFO is about ~$100 M/yr with most funding equally supplied by the USA, Israel, and Egypt. It has been argued that the number of MFO personnel and associated cost could be significantly reduced if more sophisticated sensors were used on the ground and within Open-Skies-type aircraft (e.g., perhaps to a force of ~300). However, the current arrangement appears to be satisfactory to the concerned parties.

IV.5 Humanitarian removal of land mines

Egypt is reportedly the most heavily mined country in the world. Estimates range between 20-23 million mines, but it is important to note that these estimates include unexploded ordnance, which make up a large portion of the reported numbers. The majority of the mines is located in the Western Desert and originates from World War II. They are difficult to find due to poor record keeping and to the shifting landscape over the years. The country of Jordan also has a significant problem within the Jordan River valley, but the problem is more tractable due to better record keeping. USCENTCOM is actively helping both countries

develop and demonstrate new technologies to remove land mines [24]. Within this program, R&D funds are provided by USA's Night Vision Electronic Sensor Directorate (NVESD). Sandia National Laboratories also receives funds from NVESD to develop new demining technology (e.g. smart sands [25]), so in theory, a successful Sandia technology could eventually be introduced into Egypt and Jordan Any new project ideas would have to be coordinated with USCENTCOM.

Evaluation of Proposed Project

Egypt and Jordan are not the only countries in the Middle East with a significant land-mine problem. The extent of the problem is depicted in Appendix D. Thus, any proposed projects would likely gather regional interest.

According to the United Nations, while some advances have been made in recent years, there is general consensus in the mine action community that technological developments, particularly those resulting from "high-tech" scientific R&D, have so far failed to meet field mine action needs. The adaptation of off-the-shelf technology has seen greater success. At a Demining Technology Information Forum workshop, held in Vancouver on 4-5 June 2001, the participants - who included users, scientists, developers and donors - recommended the establishment of a centralized point for information exchange on mine action technologies. They were looking for a one-stop shop that would provide them with access to all the relevant information in a user-friendly format. In view of the large number of organizations who already contribute to the process of information exchange and need to coordinate such an undertaking, the UN agreed to convene a small working group to examine the possibilities and propose a solution. It is intended that a UN information gateway, providing open access to a wide variety of mine related information including technology, will be established by the end of this year, and a technology page was established to launch the effort[12].

As a next step, we propose developing an exhibit of current and next-generation land-mine removal technology within the Middle East CMC showroom. Hands-on examples of the technology will be displayed, as appropriate. Development of the exhibit would be coordinated with the UN group developing the "one-stop shop," and with USCENTCOM. The CMC could also serve as a forum for regional workshops that focus on land-mine removal technology.

IV.6 Sharing of commercial satellite imagery to build confidence

At the request and sponsorship of the United Nations, the CMC held a workshop entitled "The Potential Uses of Commercial Satellite Imagery in the Middle East [26]." The 4-day workshop was held during the summer of 1998 and was attended by 26 scientists, remote sensing specialists, and arms control and regional security specialists from 7 Arab parties and Israel. One of the conclusions was that the applicability of imagery to the verification of potential regional arms-control agreements is limited at this time. However, its applicability will increase in the near future as new, more capable satellite systems are launched. In the mean time, most participants agreed that commercial satellite imagery is under-utilized in the Middle East and that it would be desirable to develop cooperative environmental projects within the region as a confidence building measure.

The Egyptian National Authority for Remote Sensing and Space Sciences (NARSSS) presented the most developed proposal during the workshop. The proposal suggested a regional study of the implications of global climate change in the Middle East. To begin this project, the regional parties (perhaps Egypt and Jordan, initially) would have to cooperate in deciding on a uniform format for a digital database, and then link this database to regional and international systems.

[12] http://www.mineaction.org/technology_rnd/technology_rnd_overview.cfm

Evaluation of Proposed Project

The visiting scholars did not have enough time to pursue potential projects in this area. However, they expressed interest in setting up a remote-sensing display within the proposed Middle East CMC and pursuing possible cooperative projects in the future.

Due to the extensive number of remote sensing organizations within the Middle East (see Appendix E), it is best that any new cooperative projects be launched from the Middle East CMC. Extensive brainstorming and negotiations among the parties would be required and a local body best coordinates such discussions.

IV.7 Advanced notification of aircraft overflights to build confidence

In late February, 2001, the Gulf Co-operation Council (GCC) states[13] begun operation of the Hizam Al Taawun (HAT - 'Belt of Co-operation') aircraft identification and tracking system that enable them to monitor aircraft jointly in airspace over and surrounding their territories and better co-ordinate defensive activities. The HAT system is a distributed command, control, communications, computers and intelligence network developed by Raytheon. It is linked to the national air defense systems of each GCC state and is able to track up to several hundred aircraft in real time. The system, which operates in both Arabic and English, features maps, databases and other tools to facilitate improved military-to-military planning and co-ordination. The new network builds on the GCC member states' efforts since the Gulf War to bolster their co-operative-defense capabilities. The total value of the HAT network and Communications Project exceeded $160 million.

With the help of the CMC visiting scholars, we will assess whether it is feasible for Jordan, Egypt, or some other Middle Eastern country to join the HAT network. If so, we will estimate the technical and financial requirements of the proposed incremental expansion.

Evaluation of Proposed Project

The visiting scholars did not have enough time to explore a potential project in this area. They viewed it as a military project that would take extensive negotiation to develop. This is considered a long-term project that could be investigated by the Middle East CMC.

IV.8 Efficient transference of humanitarian goods across borders

The Egyptian visiting scholars stated that it is difficult for the Red Crescent Society to send humanitarian goods from Egypt to the Palestinians in Gaza. Apparently the trucks crossing the border are stopped by the Israelis for many hours, and perhaps days, to perform a detailed inspection of the contents; the entire truck might be unpacked to ensure that weapons are not being smuggled into the country.

To make the inspection much more efficient, we recommend that "point-of-origin" customs inspection be performed. In this approach, the customs agent would inspect the vehicle for illegal goods at the packing location in Egypt. The cargo hold would be secured by the agent using Cobra-seal [14]or other appropriate technology (see Figure 6) and the truck would proceed to the border. Border police would then only need to check the integrity of the seal to ensure against tampering.

[13] GCC member states are Saudi Arabia, Bahrain, Kuwait, Oman, Qatar, and United Arab Emirates

[14] The Cobra Seal, originally developed by Sandia, is now being sold by Aquila Corporation. See product description at http://www.aquilagroup.com/pdf/cobraIII.pdf

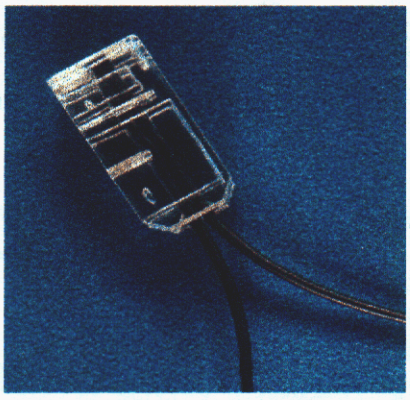


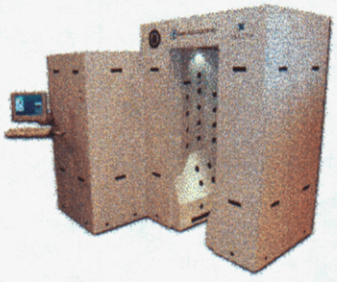
Figure 6 Cobra Seals use fiber-optic technology

Evaluation of Proposed Project

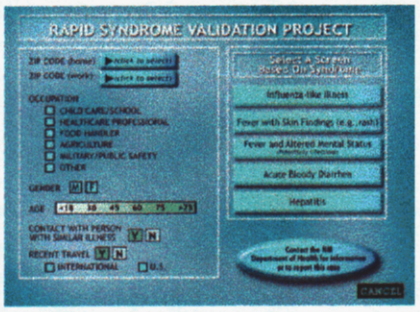
In October, we attempted to contact the Palestinian Red Crescent Society (Info@PalestineRCS.org) to learn more about this potential problem and to offer our help. We have not yet received a reply.

V. Project Summary

The Cooperative Monitoring Center (CMC) at Sandia National Laboratories performed a study entitled "Middle East Arms Control Technology Demonstration Project." The purpose of the study was to identify opportunities for deployment of arms control (AC) projects in the region that improve security and promote cooperation between 2 or more countries. With the help of visiting scholars from Egypt and Jordan, the feasibility of many types of projects were explored. These included the deployment of anti-terrorism technology at border crossings, cooperative monitoring to warn of the potential presence of WMD, land-mine removal, and open-skies-type overflights. Many of these and other projects are feasible but the study team concluded that the logical first step to launching new projects is to establish an "AC technology outpost" in the region, i.e., a CMC-like facility, either in Amman or Cairo. This facility will be fashioned after Sandia's CMC and will serve as a forum for regional training on nonproliferation technologies, indigenous development of AC technology projects, and multidisciplinary interactions among Middle Eastern technocrats, policy-makers, and security specialists. We envision that Sandia's arms-control technologies and training expertise will become an integral part of this facility. Budget for launching this project in 2002 is being secured from DOE and CMC will soon meet with DOS to finalize our plan and to gain approval for moving forward.



CMC
COOPERATIVE MONITORING CENTER



Bibliography

1. Pregenzer, A., G. Kolb, and D. Betsill, "Foreign Travel Trip Report," Trip purpose: Discuss environmental and arms-control projects related to regional security issues with several key organizations in Jordan and Egypt, Trip dates: January 19 – February 1, 2001, Sandia National Laboratories, Albuquerque, NM.
2. Spiegel, S. (ed.), *Fourth Workshop on Arms Control and Security Improvement in the Middle East*, Washington DC, June 15-18, University of California Institute on Global Conflict and Cooperation, 1999.
3. Leonard, J, et. al., *National Threat Perceptions in the Middle East,* Research Paper #37, United Nations Institute for Disarmament Research, Geneva, Switzerland, September, 1995.
4. Landau, Emily, "Egypt and Israel in ACRS: Bilateral Concerns in a Regional Arms Control Process," Jaffee Center for Strategic Studies, ISBN 965-459-045-X, June 2001. Paper can be downloaded from Jaffee Center website.
5. Hammad, Fawzy, and Adel M. Ali, "Principles of Establishing a Middle East Weapons of Mass Destruction Free Zone Monitoring and Verification System," Egyptian Atomic Energy Authority, IAEA-SM-367/9/7, Fall 2001.
6. Cordesman, A., *Weapons of Mass Destruction and Arms Control in the Middle East,* Center for Strategic and International Studies, Washington, DC, June 17, 1999.
7. Kelsey, J., et. al., *Regional Verification Technology Assessment – Asia/Pacific Rim,* DTRA-TR-00-12, prepared for DTRA by TASC, Inc., Arlington, VA, January, 2001.
8. "Treaty on Open Skies -- video tapes, audio tapes, literature," Defense Threat Reduction Agency material provided to Sandia National Laboratories, April 2001.
9. Kerner, D., et. al., *Anti-Personnel Landmine (APL) Detection Technology Survey and Assessment,* DTRA-TR-98-3, prepared for DTRA by DynMeridian, Alexandria, VA, March 1999.
10. Kolb, G. J., "Middle East Arms Control Technology Demonstration Project, Interim Report," Cooperative Monitoring Center, Sandia National Laboratories, Albuquerque, NM, May 1, 2001.
11. Pregenzer, Arian L., *Crisis Prevention Centers as Confidence Building Measures - Suggestions for the Middle East,* Sandia National Laboratories, Albuquerque, NM, SAND95-0919, May 1995.
12. Yaffe, Michael D., "Promoting arms control and regional security in the Middle East," in *Disarmament Forum*, UNIDR, United Nations, Geneva, p 9-25, March 2001.
13. Qasem, S., "The Arab States" in UNESCO *World Science Report*, UNESCO, Oxford University Press, p 151-165, 1998.
14. Rached, Eglal and Dina Craissati (eds.), *Research for Development in the Middle East and North Africa*, International Development Research Center, ISBN 0-88936-930-5, 2000. May be downloaded at http://www.idrc.ca/acb/showdetl.cfm?&DID=6&Product_ID=571&CATID=15#toc
15. Netzer, G., *A Generic Model for Cooperative Border Security,* SAND 98-0505/7, Sandia National Laboratories, Albuquerque, NM, March, 1999.
16. Qojas, M., *Cooperative Border Security for Jordan: Assessment and Options,* SAND 98-0505/8, Sandia National Laboratories, Albuquerque, NM, March, 1999.
17. "Letter of Intent between the Department of Energy of the United States of America and the Atomic Energy Commission of Israel on Cooperation in the Fields of Nonproliferation, Arms Control, and Regional Security," Signed by Bill Richardson (USDOE) and G. Frank (IAEC) on February 22, 2000.
18. Fahah, Alim A., et. al., *Guide for the Selection of Chemical Agent and Toxic Industrial Material Detection Equipment for Emergency First Responders, Volume 2, National* Institute of Justice, NIJ Guide 100-00, June 2000.
19. Zelicoff, A., R. et. al, Rapid Syndrome Validation Project, http://epi.health.state.nm.us/rsvpdesc/default.asp
20. Krepon, Michael, and Peter D. Constable, "Confidence Building, Peace-Making, and Aerial Inspections in the Middle East", Occasional Paper #6, Henry L. Stimson Center, Washington, DC, January 1992.
21. *Open Skies, Arms Control, and Cooperative Security,* Articles #5 and #12, St. Martins Press, NY, Henry L. Stimson Center, ISBN0-312-06603-1, 1992.

22. Steinberg, Gerald M., "Commercial Observation Satellites in the Middle East and Persian Gulf," in *Commercial Observation Satellites,* edited by J. C. Baker, et. al., RAND Corp., p 225 - 245, 2001.
23. See Website for Multi-National Force of Observers, http://www.iaw.on.ca/~awoolley/mfo.html
24. USCENTCOM Demining Program,
Egypt: http://www.centcom.mil/demining/egypt_demining_program.htm#DEMINING
Jordan: http://www.centcom.mil/demining/jordan_demining_program.htm
25. Simonson, R. J., "Dstributed Granular Sensor System for Remote Optical Detection of Trace Chemical Signatures: Application to Land Mine Detection," Sandia National Laboratories, Albuquerque, NM, April 13, 2000.
26. United Nations, *The Potential Uses of Commercial Satellite Imagery in the Middle East,* prepared by Cooperative Monitoring Center (Sandia National Laboratories) for United Nations Institute for Disarmament Research, Geneva, Switzerland, September, 1999.
27. Technical Support Working Group, *Program Overview 2000*, Combating Terrorism Technology Support Office, request from tswg@tswg.gov
28. Information gathered by the US Department of State
http://www.state.gov/www/global/arms/rpt_9809_demine_nxa.html

Appendix A
ME Participation in Major International Treaties

Country	NPT	BWC	CWC	CTBT	1997 Land-mine	Open Skies[16]
Egypt	**R**	**S**	--	**S**	--	
Jordan	**R**	**R**	**A**	**R**	**R**	
Israel	--	--	**S**	**S**	--	
Saudi Arabia	R	R	R	--	--	
Bahrain	R	A	R	S	--	
Kuwait	R	R	R	S	--	
Oman	R	R	R	--	--	
Qatar	R	R	R	R	R	
UAE	R	S	S	R	--	
Syria	R	S	--	--	--	
Lebanon	R	R	--	--	--	
Iran	R	R	R	S	--	
Iraq	R	R	--	--	--	
Yemen	R	R	S	S	R	
Morocco	R	S	R	R	--	
Tunisia	R	R	R	S	R	
Algeria	R	--	R	S	S	
Libya	R	A	--	--	--	

R – Ratified A – Acceded S – Signed

Appendix B
ME Participation in UN Register of Conventional Arms[17]

The Middle East and North Africa has historically been a region of very low rates of Register participation, with only Israel and Iran making reports on a regular basis, with Jordan irregularly providing ('nil') reports. Members of the Arab League, led by Egypt, have refused to participate in recent years, citing dissatisfaction with the fact that the Register does not encompass weapons of mass destruction. This low rate of participation is a particular concern because the region is the world's largest market for arms exports.

This may now be beginning to change. For the first time since 1993, two Arab League States (Jordan and Qatar) reported imports of conventional arms to the Register. In a further sign that at least some Arab States may be warming to the Register, the year Bahrain, Jordan, Kuwait, Oman, Qatar, Tunisia and UAE voted in support of the annual Resolution in support of the Register in the UN First Committee and UN General Assembly. Nevertheless, Egypt, Algeria and other Arab countries remain unhappy with the Register, and indicated this by abstaining on this General Assembly resolution.

By March 1999, no reply had yet been received by Iran, which has provided information for every one of the Register's first five years. Iran has often been very late in providing a reply in the past. Moreover, its replies have so far always exactly matched those previously submitted by its suppliers, amongst which China has been prominent. It would not be seen as coincidental if Iran decided to stop providing information in the same year as China also did so.

---

[16] According to the Defense Threat Reduction Agency, Middle East countries could be invited to join after the treaty enters into force.

[17] Besides the UN official register, an unofficial register has been compiled. See "Online Middle East Net Assessment Reports," http://www.csis.org/mideast/online.html

Appendix C

Establishing a Center for Cooperative Monitoring in Cairo, Egypt (CMC @ Cairo)

- Towards a New Paradigm -

Fawzy Hammad, Adel Ali (Egyptian Atomic Energy Authority)

Ali Ajlouni (Royal Scientific Society of Jordan)

Ahmed Hassan (University of New Mexico)

INTRODUCTION

The Middle East is one of the most dangerous regions in the world. It has suffered conflicts and wars- with weapons of mass destruction (WMD) implications- at higher frequency and intensity, than any other region during the last 60 years. Significant successes have occurred during the Oslo peace process, yet it has encountered serious obstacles, delays, and setbacks. The current situation, resulting from lack of cooperation and the escalating clashes between Israel and the Palestinians in the occupied territories, severely threatens peace and security in the Middle East. The Oslo process begun in 1993 is in ruins; the Arms Control and Regional Security (ACRS) talks of the Multilateral Peace Process have been stalled since 1995. Several countries in the Middle East remain outside international nonproliferation regimes and are not party to critical treaties such as the NPT, CWC and BWC. Besides this situation, there are several international and regional events that present serious cause for concern in the region:

- The dissolution of the Soviet Union and the potential leakage of WMD-related expertise, technology and materials to the Middle East
- The collapse of the UNSCR 687, and its non-cooperative monitoring and verification system in Iraq in late 1998
- The nuclear tests in India and Pakistan in 1998 and their refusal to sign CTBT
- The standstill of efforts to establish a Middle East WMD Free Zone,
- The rise of sub-national political groups willing to use violence to achieve their goals

In this volatile atmosphere, the risk of WMD (nuclear, chemical, and biological) proliferation and use is increasing. Further, the Middle East was the largest importer of conventional weapons in the world over the last decade. This arms race continues and is fueled by the political, military, geographic and demographic asymmetries in the region as well as stockpiles of WMD and missiles. Political relations are probably the worst since the mid-1970's. This grave situation may lead to war in the region using WMD with devastating results.

As the ACRS process slowed to a halt, a significant unofficial effort (Track-2) was devoted to studies, dialogs, meetings, and conferences by regional and international organizations. These *ad hoc* activities are useful but have not been sufficient to halt the deterioration of regional trust. Indeed, the Middle East is in a state of impasse. A new way forward must be found, to salvage the situation.

A NEW PARADIGM

A new paradigm is needed to escape the current impasse and pave the way for a stable Middle East that would include a cooperative regional security regime free from WMD. The new paradigm must be based on institutionalized, planned, systematic, cooperative and sustained efforts to address Middle East peace and security issues using the full spectrum including a wide range of available monitoring technologies and techniques. Establishing a Cooperative Monitoring Center in Cairo, Egypt (CMC@Cairo) to address these issues will be a critical building block in this new paradigm. The CMC@Cairo will act as a national and regional forum to facilitate cooperation through the innovative application of technical tools. The CMC@Cairo will be patterned after the internationally focused Cooperative Monitoring Center (CMC) of Sandia National Laboratories (CMC@Sandia) in the United States and be cooperative with it.

Cooperative monitoring deals with the process of obtaining and sharing of agreed information among parties to enhance their security. This approach was used with success in nonproliferation, arms control and disarmament treaties as well as confidence building and security measures in recent years. The (CMC@Sandia) was established in 1994 to institutionalize this approach and enhance the technology component in monitoring. The CMC @ Sandia, which in the first of its kind, developed a wide range of bilateral and regional cooperative programs. It also assists in building infrastructure and capacity to develop and implement security arrangements, reduce regional tensions as well as extend the use of monitoring technologies to enhance sustainable development. This experience, expertise, technological capacity and methodology of CMC@Sandia will be a great asset to the CMC@Cairo in addressing Middle East peace and security.

MISSION

The mission of the CMC@Cairo is to promote the role of cooperative monitoring in security and sustainable development nationally and regionally.

GOALS

The goals of the CMC@Cairo are to:

- Enhance the role of science and technology in nonproliferation, arms control, and disarmament (NPACD), and other security issues.
- Promote cooperative monitoring technology, methodology, and culture.
- Strengthen the technical infrastructure and capacity to address the NPACD concerns.
- Bridge the gap between technical and political issues.

OBJECTIVES

Objectives that support these goals are:

- Develop cadres of national and regional experts, supported by adequate technological and information- knowledge infrastructure.
- Promote the demonstration, application, and development of appropriate monitoring and verification *technologies* and enhancing their effectiveness, synergy and cost - effectiveness
- Strengthen capabilities to design cooperative monitoring and verification systems (CMVS).
- Promote the use of monitoring technologies and systems in other applications e.g. environmental security, natural resources, energy, public health, emergency planning and response

The CMC@Cairo will provide a forum where national and regional experts and decision-makers can meet to consider how technology can help achieve regional security objectives. It will provide information, education, training, research, studies and a hands-on working environment. Essential elements to achieve the objectives include:

- Establishing *professional relationships* with national, regional, and international security experts
- Conducting *joint studies* that develop ideas for technical collaborations, and common understanding on regional security
- Developing *technical experiments* that allow participants to "test-drive" the technology
- *Implementing projects* and activities that accomplish national and regional cooperative objectives.

MAIN ACTIVITIES

The long-term vision of the CMC@Cairo includes the following principle activities:

Training

- Develop education and training strategies which aim at development and strengthening cooperative approaches, strengthening the technology component, achieving professional standards, developing training programs for trainers as well as training materials and tools.
- Conduct national and regional training courses on cooperative monitoring technologies for NPACD, and material protection and control.
- Establish partnerships with relevant graduate programs in some universities

Research and Analysis

- Establish research programs and studies, under the supervision of leading experts and academics, on the role of technology in regional security issues, nonproliferation and disarmament problems.
- Promote cooperative projects in scientific and technological areas related to complex regional issues
- Explore new approaches and ideas to enhance regional security and stability
- Establish visiting scholars programs to enable young graduates to participate in addressing such areas

Technology Demonstrations and Development

- Demonstration of a broad range of unclassified, monitoring technologies and systems.
- Development and testing of monitoring systems for national and regional applications.
- Conducting monitoring experiments to assess new approaches to monitoring.
- Promoting the use of monitoring technologies and techniques for economic development, enhancing safety, public and environmental security.
- Develop modeling and simulation tools for on-site inspection training and system design
- Enhancing the role of information knowledge management.

PARTNERSHIPS

To increase the impact of the CMC@Cairo activities, it will coordinate and establish partnership with CMC @ Sandia and other agencies, research centers, universities, non-governmental organizations, industry, as well as regional and international organizations (IAEA, UNIDIR).

COOPERATIVE MONITORING AND VERIFICATION SYSTEM (CMVS) IN EGYPT

Egypt has a history of participating in cooperative monitoring regimes. One of the first examples of regional CMVS was established in Sinai, Egypt to provide monitoring and verification of the Sinai I agreement (1974), the Sinai II agreement (1975), and Egypt-Israel Peace Treaty (1979). Several monitoring technologies and verification procedures were used to ensure confidence and compliance with the agreements. The US and the UN supported the agreements as third parties to Egypt and Israel. Upon successful completion of the mission, the CMVS was removed. This activity sets a precedent for cooperative monitoring and verification in the Middle East

Egypt has an established institutional structure. It has a fully developed civilian R&D nuclear program and significant experience with automated, remote monitoring for applications ranging from nuclear safety to meteorological parameters. It has been a member of the IAEA since 1957 and the Nonproliferation Treaty since 1982. Egypt has developed broad experience in safeguards and other nuclear monitoring approaches. Egypt also has a National Authority for Remote Sensing and space science that plays a regional role in analysis of commercial satellite imagery.

The Egyptian Atomic Energy Authority (EAEA) would be an ideal location for the CMC@Cairo. The EAEA has broad relevant scientific and technical expertise among its staff. It also has significant experience with monitoring technologies, including experience with IAEA safeguards and a safeguards laboratory. Perhaps most importantly, the EAEA has a vision for the CMC@Cairo and a strong interest in hosting the center. It has expressed willingness to provide a facility for the center and to provide in-kind contributions such as technical personnel and administrative assistance.

INFRASTRUCTURE REQUIREMENTS AT EAEA

Initial infrastructure requirements (envisioned to be established over the first two years) include:

- Establish the CMC @ Cairo within an existing facility at EAEA. The candidate facility is located at EAEA's Nasr City site, in eastern Cairo. The existing facility has adequate office space, conference facilities, and space for a cooperative monitoring technology showroom (see Figure C-1). The floor space is ~1000 m^2 and the rental value is ~$48 K/yr. The flexibility of the CMC @ Cairo to host foreign nationals will allow it to become a center with a true regional and international focus. EAEA will provide this facility.

- Provide manpower for the CMC @ Cairo. The envisioned staff is depicted in Figure C-2 and will be provided by EAEA. The value of the workforce is shown in Table C-1.

- Install computer hardware and software, high speed Internet link and a modern communication system. We propose that CMC @ Sandia provide this infrastructure.

- Establish information-knowledge management system and a modern library. We propose that CMC @ Sandia provide this infrastructure (See Table C-2).

- Set up cooperative monitoring technology displays within the technology development laboratories. We propose that CMC @ Sandia provide this infrastructure.

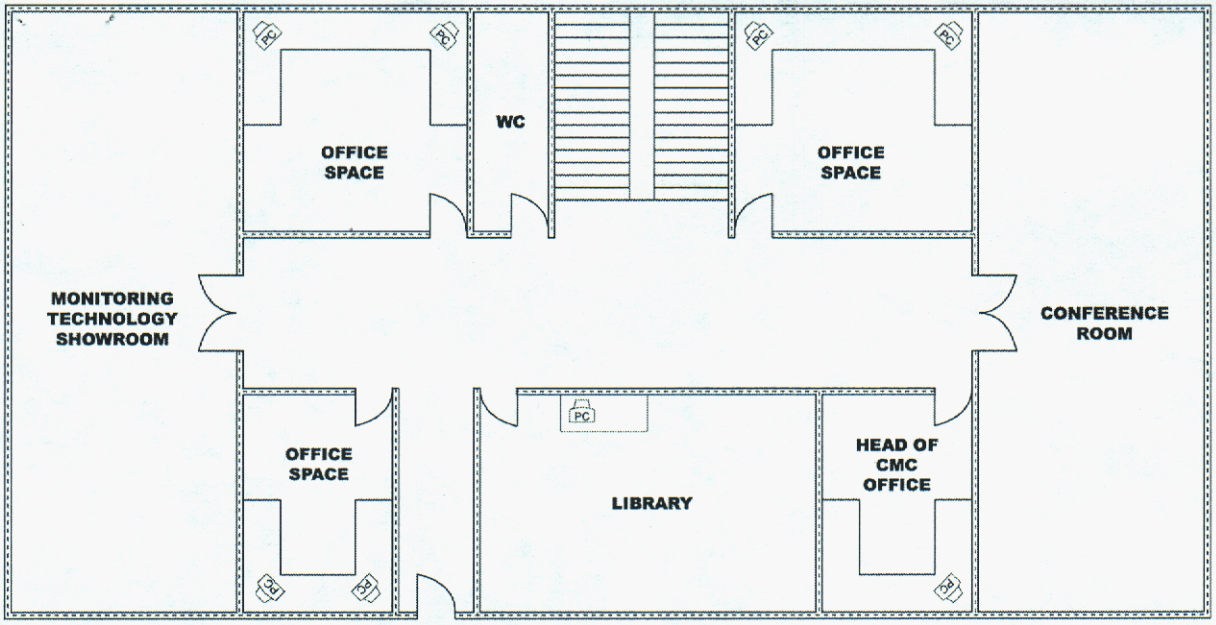


Figure C-1 Proposed CMC @ Cairo facility located within EAEA's Nasr City site.

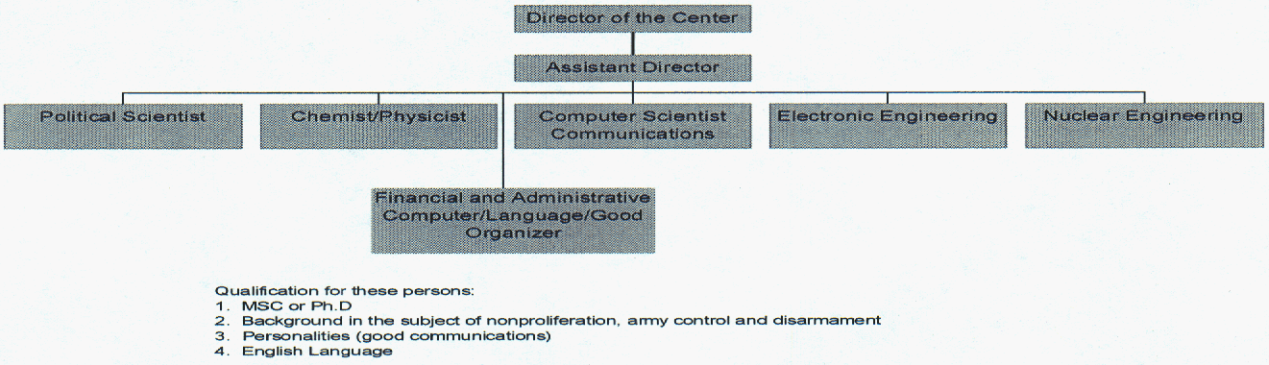


Figure C-2 Envisioned manpower for the proposed CMC @ Cairo

Table C-1
Value of CMC @ Cairo Manpower

Item	Cost	
Director of CMC	$4K/Month	$48K/YR
Assistant Director	$3K/Month	$36K/YR
Six Researchers	$12K/Month	$144K/YR
Total	$19K/Month	$228K/YR

Table C-2
Cost Breakdown for the Physical Library

Item	Cost
Periodicals	$6K/yr
Videos	$3K/yr
Books	$10K/yr
Reports	$5K/yr
PC Computer	$2K/yr
Total	$26K/yr

Appendix D
Land Mines in the Middle East [28]

Country	Mines
Egypt	22,500,000
Jordan	206,000
Israel	260,000
Saudi Arabia	0
Bahrain	0
Kuwait	Unknown
Oman	Unknown
Qatar	0
UAE	0
Syria	100,000
Lebanon	8000 to 35000
Iran	16,000,000
Iraq	10,000,000
Yemen	100,000
Morocco	200,000
Tunisia	Unknown
Algeria	Unknown
Libya	100,000

Appendix E
Remote Sensing Organizations in the Middle East [22, 26]

Country	Organization
Egypt	National Authority for Remote Sensing and Space Sciences
Jordan	Royal Jordanian Geographic Center
Israel	Image Sat International's EROS Program
Saudi Arabia	Saudi Center for Remote Sensing
Bahrain	
Kuwait	Kuwait Institute for Scientific Research
Oman	
Qatar	University of Qatar
UAE	Dubai Space Imaging Company
Syria	General Organization of Remote Sensing
Lebanon	National Center for Remote Sensing
Iran	
Iraq	Space and Astronomy Research Center
Yemen	
Morocco	Royal Center for Remote Sensing
Tunisia	
Algeria	
Libya	Libyan Center for Remote Sensing and Space Science